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COPING WITH RAPID TECHNOLOGY ADVANCEMENT

FROM AN AUSTRALIAN PERSPECTIVE

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The problem of acquisition processes that cannot keep up with the rate of technological advancement is important to most military organisations. The ability to quickly field equipment that capitalises on technological innovation is becoming more important. The advances in computers and communications have enabled commercial organisations to catch and exceed the growth of defence technology. This reversal from the previous period post-WWII has made it increasingly difficult for the many technologyoriented military organisations to maintain a technology edge over potential adversaries. The process of fielding new technology equipment in the military can be divided into three main areas. The first area is research and development (R&D) which is limited by the level of funding provided. With shrinking budgets the main methods available to increase the effort are through limiting the scope of the R&D or through cooperation with other nations or agencies. Next is the acquisition phase which is already subject to streamlining initiatives worldwide to reduce some of the unnecessarily bureaucratic procedures. However, for reasons of accountability there is a limit to the time-frame possible in most democratic countries due to scrutiny requirements and budgeting procedures. Finally, the during the integration of new technology equipment into fielded forces, there is potential to save considerable time through innovation that can both integrate equipment into the current structure and adapt the structure to take full advantage of new technology. This paper will discuss what the military can do to field new technology more rapidly, in the R&D, acquisition and integration phases from an Australian defence perspective.

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Preface

The topic for this paper was adapted from some areas of interest supplied to me by the Royal Australian Air Force's Air Power Study Center, with thanks to SQNLDR Chris "Shortie" Westwood for his liaison. The problem of trying to keep up with technology acquisition is of concern to many nations military forces. However, to military forces like Australia, that rely on technology to maintain a capable force with shrinking budgets, it is crucial. The support of Major Chris Cook who acted as my Faculty Research Adviser for this project is also appreciated, especially during the early stages while coming to terms with a subject out of my usual field.

Abstract

The problem of acquisition processes that cannot keep up with the rate of technological advancement is important to most military organisations. The ability to quickly field equipment that capitalises on technological innovation is becoming more important. The advances in computers and communications have enabled commercial organisations to catch and exceed the growth of defence technology. This reversal from the previous period post-WWII has made it increasingly difficult for the many technology-oriented military organisations to maintain a technology edge over potential adversaries.

The process of fielding new technology equipment in the military can be divided into three main areas. The first area is research and development (R&D) which is limited by the level of funding provided. With shrinking budgets the main methods available to increase the effort are through limiting the scope of the R&D or through cooperation with other nations or agencies. Next is the acquisition phase which is already subject to streamlining initiatives worldwide to reduce some of the unnecessarily bureaucratic procedures. However, for reasons of accountability there is a limit to the time-frame possible in most democratic countries due to scrutiny requirements and budgeting procedures. Finally, the during the integration of new technology equipment into fielded forces, there is potential to save considerable time through innovation that can both integrate equipment into the current structure and adapt the structure to take full advantage of new technology.

This paper will discuss what the military can do to field new technology more rapidly, in the R&D, acquisition and integration phases from an Australian defence perspective.

Chapter 1

Introduction

> *While new technologies provide new opportunities for Australia's defence, they will also expand the challenges we face.*
>
> —Defending Australia, 1994.

The 1980s and 1990s have been dominated by two areas of technology, computers and communications. Previously, the influence of World War II (WWII) and the Cold War had seen the military leading most technological developments with amazing advances such as the development from the propeller aircraft of the 40s to the supersonic jets of the 50s and the spacecraft of the 60s. However, the invention of the computer and more importantly the mass production of powerful microprocessors gave organisations outside the military the ability to accelerate their own developments. These non-military developments along with rapidly expanding global communication systems, created markets for high technology equipment that were not reliant on the defence industry.

Previously, the military had controlled, influenced and guarded a significant technology advantage over the commercial and industrial sector. During the post WWII period an acquisition process was developed that was driven by the bureaucracy and suited to the more gradual military-lead pace of technological advancement. The main factor in technological advancement was maintaining a force advantage over real or potential adversaries, who were also advancing at a more gradual rate. These influences

created an acquisition system that took up to 10 years or more to operationally field new equipment. However, in the 1970's and 1980's commercial and industrial organisations with access to powerful computer and communication systems soon began outstripping the technology developments of the defence industry. The current period has seen exponential computer growth with a 10-fold increase in transistors about every 5-10 years and an increase in computing power of 4000 times per unit cost each decade.[1] For the military acquisition system it has meant that much of the technology included in military equipment is outdated before introduction into service.

Assuming all military forces are suffering from the same problem then this presents no great problem as force parity can be maintained. However, smaller and more newly developed forces and organisations without the encumbrance of the bureaucratic framework have access to commercial-off-the-shelf (COTS) technology in many cases superior to that of the most advanced large military forces. This situation has created a widespread climate for reform of the processes of integrating new technology into military equipment, to ensure that the limited defence dollar is not spent on technology that will be rendered obsolete by the time it is fielded. An important part of this discussion is the definition of obsolete being based on lack of capability against adversary systems, rather than just old.

This paper will examine three important areas in the military technology integration process, research and development (R&D), acquisition, and operational integration. Current acquisition reforms are focussing on removing steps or streamlining many of the mechanical processes involved in the procurement and budgetary processes. However, the financial accountability and parliamentary control required in most democracies limit the

ability to completely remove the bureaucracy. The worldwide reductions in military spending are also applying pressure to all the processes to ensure value for money, and can lead to the adoption of a methodology for selecting only tried and tested, but older, technology. This can delay implementation of leading edge technology, but reduces some of the risks and costs of early adoption of high technology equipment. However, structures that allow the application of the processes in parallel, or the focussing of effort into specific areas can realise savings by reducing the bottlenecks present in the current sequential systems, and can reduce many of the risks involved in the selection of leading edge technology. This paper will highlight initiatives in all three areas and concentrate on strategies and focus the discussion on the particular needs of the Australian Defence Force (ADF).

Notes

1. John L. Petersen, *The Road to 2015* (Corte Madera, California: Waite Group Press, 1994), 29-30.

Chapter 2

The Pursuit of High Technology

> *...our initial examination of the MTR strongly supports the hypotheses that, sooner or later, leading military powers will exploit available and emerging technologies, making major changes in the way they prepare and conduct operations in war and realising dramatic gains in military effectiveness.*
>
> —Andrew F. Krepinevich Jr.

The acquisition of high technology could result from either new structures and doctrine driving the development of technology and equipment, or new technology with military applications driving changes in the military. That is, either a Revolution in Military Affairs (RMA) or a Military Technological Revolution (MTR). Understanding a country's need to maintain a high technology military force needs to be examined before highlighting why or how it can be done.

One of the reasons for chasing high technology is to physically obtain the equipment to fulfil a particular capability need or mission. Another reason is to enable the development of doctrine and force structures associated with the new technology and equipment. The period prior to WWII highlights the importance of the second, with the actual military equipment of the period 1920-35 being of little influence during WWII, while the doctrine developed during the interwar period influenced the initial employment of the equipment.[1]

For example, the thinking of people like William ("Billy") Mitchell and groups like the US Air Corps Tactical School (ACTS), combined with the civilian aircraft industry's emphasis on large aircraft, drove the US Air Corps focus on heavy bombers. This strategic bombing doctrine dampened the development of long-range fighters, and large numbers of the vital P-51s and P-38s did not arrive in Europe until two years after the war began. Even after the aircraft arrived, it took several months of trial and error to devise their optimum method of employment. This shortfall in long-range fighter inventories and employment was a direct result of interwar thinking.[2] This example highlights both of the problems of not keeping up with technology, firstly the equipment required for the mission was not available, and secondly its effective employment was delayed while tactics and doctrine were developed.

The requirement to have high technology equipment to provide specific military capabilities stems from different national characteristics. Australia has a large area to defend but has a small population base to support its goals, and employs a policy of high technology equipment with relatively few highly trained personnel. America's pursuit of high technology stems from a similar philosophy of using technology as a force multiplier to balance the huge manpower-based forces of its former adversaries. Current worldwide budgetary restraints also see a "Western" emphasis on the use of high technology equipment to provide a similar or better capability from a small force.

The use of technology and equipment in the development of doctrine is the other driving force in the desire for acquiring new technology. An example can be seen in Australia's acquisition of aerial refuelling, the equipment is considered only a training capability providing only slight enhancement to operations due to the limited fuel off-load.

However, there have been significant changes in fighter employment and doctrine as a result of its availability. Similarly, the use of AWACS aircraft by Australian forces in combined military exercises has allowed the process of doctrine development to begin prior to Australia's own acquisition. Again the pursuit of high technology, in this case through exercises with other countries rather than acquisition, has been based on perceived future needs.

The other important consideration in this discussion are the concepts of a revolution in military affairs (RMA) and a military technical revolution (MTR), whereas a RMA has military changes pulling the development of technology, a MTR offers new technology that pushes change on the military. The following table summarises the characteristics and cycle of RMAs and MTRs.

Event Sequence	**MTR**[3]	**RMA**[4]
1	Technological change	Concept Pull
2	Military systems evolution	Procedures that implement concept
3	Operational innovation	Organisation that facilitates procedures
4	Organisational adaptation	Technology that enables/facilitates

Table 1. RMA / MTR General Characteristics

While there are often arguments over the classification of historical military developments, generally an RMA will make the process of equipment integration easier due to the equipment being designed to perform a desired role or address a specific military problem or vulnerability. An example of an RMA would be the development of landing craft in support of amphibious operations. The developers are already aware of what the forces need the equipment to be capable of since the doctrine for it is already established. The

integration of technology from an MTR is generally more difficult because the direction of technology may not have been foreseen, and the military application or effective equipment employment may take a long time to develop. A good example here is the MTR created by the invention of aircraft, taking nearly 40 years and two world wars for most military forces to develop what are now considered the basics of airpower employment.

There are four main emerging technologies with obvious application to the military, information, command and control (C2), penetration and precision. Previously there were glimpses of technology in each of these areas but commanders never had all four. The synergistic use of these technologies will offer considerable potential for military changes.[5] One problem that emerges with new technology is the obvious desire to defeat the new capabilities. For example, the thinking that the development of an anti-tank weapon would make tanks obsolete. This unfortunately is an example of confusing obsolescence with vulnerability, the best attack is to learn to exploit the capabilities and flaws of the new technology while adapting to the new environment.[6] A succinct summary of this is provided in the following excerpt from the book Future Wars.

> Throughout history, militaries have reacted differently to new technologies. Some opted to overlay new technologies on top of their current ways of doing business. They used new technologies to improve the efficiency of what they were already doing. Other militaries recognised the same new technologies as drivers of fundamental change. To realise the full benefit of the new technologies, they remade themselves; they remade their doctrine and their organisation. In so doing, they gained substantial battlefield advantages over those who only overlaid new technologies on top of existing doctrine.[7]

The book Future Wars also provides a good historical example of these reactions to new technology with a study of the differences between Germany and France in WWII

tank warfare. While both had roughly equivalent quantities and capabilities of equipment, the French used tanks to better support its current infantry employment while the Germans made radical changes in its organisation with Panzer divisions and developed new doctrine with blitzkrieg. The French use of tanks did provide better support to their infantry making them more effective, however the changes made by the Germans to make full use of the new capabilities of tanks created a clear advantage in operations. This highlights the importance of developing new doctrine and supporting organisational structures when exploiting radically new technologies.[8]

The preceding discussion shows some of the reasons for maintaining technology, but also emphasises the need for accompanying changes in organisation and doctrine in support of the new technology to realise its full potential. The key to an RMA development is in encouraging the development of new concepts to begin the cycle shown in Table 1, and once accepted the concept will pull the military through the change. In a MTR, after military applications of new technology are discovered, the key to progress is in a forward looking military able to adapt its organisation and doctrine to realise the full potential of the new technology. Finally, it is important that the new technology is sought to satisfy an identified current need, or perceived future requirement to make the process worthwhile.

Notes

1. Jeffery R. Barnett, *Future War* (Maxwell AFB, Alabama: Air University Press, 1996), 26.

2. Ibid., 25.

3. Andrew F. Krepinevich Jr. "The Military-Technical Revolution: A Preliminary Assessment" in *War Theory*, (Maxwell AFB, Alabama: Air University Press, July 1996), 45-46.

Notes

4. Matt Caffrey, “Revolutions in Military Affairs”, lecture, Air Command and Staff College, Maxwell AFB, Alabama, 10 September 1996.

5. Barnett, 15.

6. Ibid., 16.

7. Ibid., 14.

8. Ibid.

Chapter 3

The Australian Defence Strategy

> *Australia's vast distances, small population, and often harsh environment make high technology the key to the nation's defence. Sophisticated surveillance and communications systems overcome the difficulties of distance, and "smart" weapons give our numerically small forces great striking power.*
>
> —DSTO Web Site

Australia has unique defence requirements created by its size and geography, coupled with a small population and limited infrastructure. This challenge has seen the development of a small defence force based on high technology equipment and skilled personnel. Air power is a key component in the defence of Australia, as it is uniquely able to offer the rapid mobility and flexibility required for operations over such a wide area and varying terrain. Australian military airpower is primarily employed by the RAAF which operates the majority of the fixed wing assets. The Australian Army and Navy operate all the Australian Defence Force (ADF) military rotary wing assets, and a limited number of fixed wing assets. An important contribution is also made by the private Coast Watch organisation which operates aircraft under contract to the Australian Government for coastal surveillance, supplementing the RAAF's maritime fleet.

Natural Defences

The geography of Australia provides several advantages in defence, the isolation of the land mass creates a natural barrier to invasion. A lodgement on Australian soil and the follow-on sustainment of those forces would attract a significant cost. However, the huge size of the area required to be defended also creates an enormous defensive problem in the detection of, and response to, a lodgment once established. Figure 1 is a map of the Australian region, illustrating the isolation of the Australian continent from other land masses.

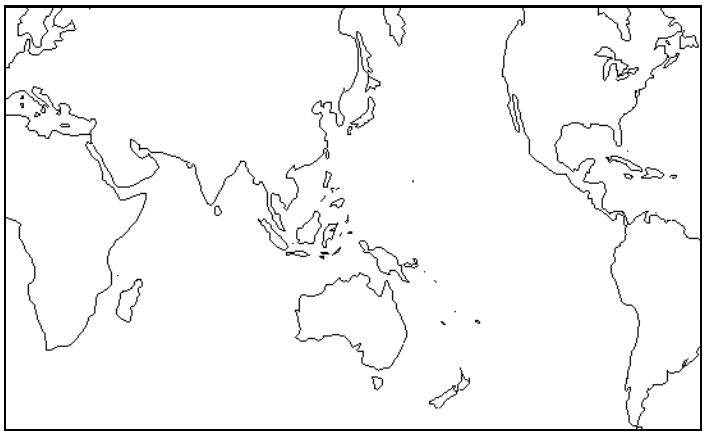

Figure 1. Map showing the Australian Region

The closest land mass to Australia is to the North, presenting the shortest path for crossing the air sea gap to Australia. This has seen an emphasis on the build-up of infrastructure and training to support operations in the northern area of Australia. The northern area of Australia is sparsely populated, and presents a large range of possibilities for an enemy to land forces and establish a lodgment well clear of any population center or military installation. The key to the defence of this area is in the protection of the air and sea approaches, through the integrated efforts of air, land and naval forces. In support of

this defensive strategy, a chain of bases and bare-bases has been constructed across northern Australia, enabling the forward staging of air power in response to a threat.

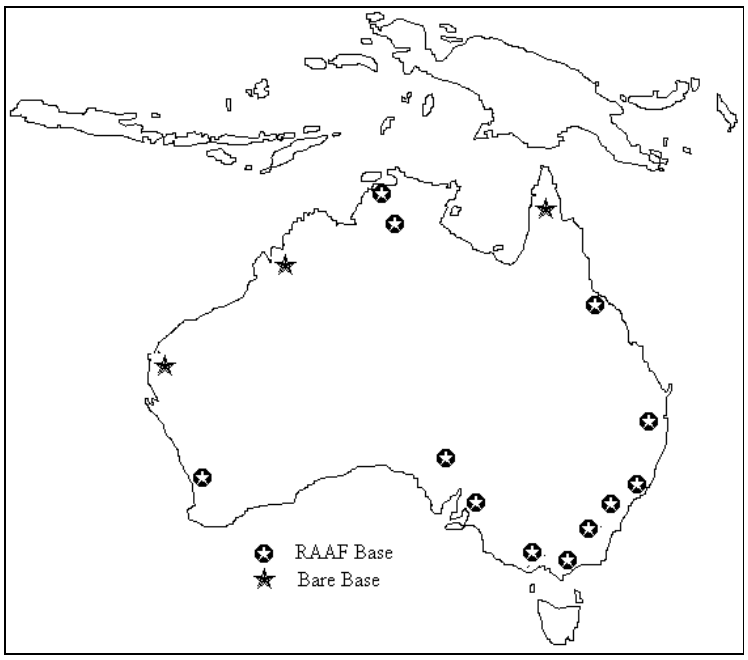

Figure 2. Map of Australia's main military airfields

Figure 2 shows a map of Australia, with the chain of operational and bare bases in support of this strategy of northern defence. However, even with this chain of bases there are huge distance problems for the Australian Defence Force (ADF), the coastal gaps between Northern bases range from approximately 700km to 1700km (400nm to 900nm) highlighting the vast distances involved in the defence of Northern Australia.

The other important aspect of Northern Australia is its climate, which consists of two main seasons. The dry season runs from April to September, and the wet season from October to March. For a significant period of the wet season a great deal of Northern Australia is inaccessible by land, and during these periods air transport is a key to rapid mobility.

This highlights the importance of air power to the defence of Australia, both in land operations within Australia, and operations forward from the coast line. This basic understanding of Australia's defensive strategy enables an assessment of the key air power capabilities, which include large area surveillance, sensitive aircraft sensors, and command, control and communications (C3) equipment. Maintaining a current list of these key areas, as is carried out in the regular Defence White Papers, is important in providing focus and prioritisation of projects for both R&D and procurement.

The challenges created by the large operating area combined with the range of capabilities required of a small force create the climate for maintaining the equipment at the leading edge of technology. Australia's fixed wing air power capabilities are currently provided by the F/A-18, F-111, P3C, C130, 707 AAR, and Caribou aircraft. All of these aircraft have been subjected to upgrades and adaptation to maintain their technology and suitability to Australia's specific needs.

Australia's Historic Technology Advantage

Australia has enjoyed a technological advantage over military capabilities in its region since the end of World War II. The shock of the WWII Japanese attacks reaching mainland Australia, and the opportunities of the Cold War era, sharpened Australia's focus on developing a capable military force. This is eloquently detailed in a statement by a former RAAF Chief.

> It is axiomatic that, all else being equal, a military force with high quality leadership, people and equipment is likely to prevail. When the war in the Pacific started, the RAAF's equipment was second-rate. The young men who took off to fight in Wirraways, Buffalos and Hudsons against the brilliant Japanese Zero were placed in an invidious position no warrior should ever have to accept. At least however, the lesson was learnt, albeit

> at an unacceptable cost. Since then it has been an article of faith that only the best equipment is good enough.[1]

This technological advantage was made possible through two main channels. Firstly, the close alliances with the UK and the US provided access to advanced military equipment and weapons to help maintain a Western balance in the Asia-Pacific region during the Cold War years. Secondly, through the scientific research and development carried out by Australia in areas of interest to the military of specific or unique pertinence to the region. Typically, this included modifications to cope with the operating environment or enhance the function or flexibility of the equipment. During this period, the RAAF's operations were concentrated in forward bases in South-East Asia, mainly in Malaysia and Singapore as part of the Five Power Defence Agreement (FPDA) along with Malaysia, Singapore, New Zealand and the United Kingdom. This agreement was mainly established for the defence of the Malaysian peninsular, but was an important part of the existing strategy of defending the land chain leading to Australia.

Prior to the end of the Cold War between the superpowers, the growth of the Asian region saw a reduced requirement for military assistance, and this along with financial pressures, lead to a gradual pull-back of forces from Asia. The last permanent overseas based fighter squadron left Malaysia in 1988, replaced by annual rotational deployments to Singapore, Malaysia and Thailand. Just prior to this time, a new defence strategy for Australia was published based on forces initially operating from within Australia. This was published in the Defence White Paper 1987, and updated in the Defence White Paper 1994, known as Defending Australia 94 (DA94).

Australia's New Strategy

This new strategy was important in refocussing Australia's defence requirements to the changing mission and operating area, with the increasing restraints on defence spending. At the same time, tremendous economic growth within the Asian region had generated increasing levels and capabilities of military equipment. This stimulated a need to adapt equipment, tactics and doctrine from that inherited and developed from working with our allies in Asian and European theatres, to one that is still compatible, but more suited to operations required for the defence of the Australian mainland. The Australian policy of defence self-reliance was further developed at the end of Cold War due to reductions in allied military commitments in South East Asia, and to keep more defence spending within the Australian economy. This has been achieved through measures such as the requirement for defence contracts to provide levels of Australian Industry Involvement (AII). Along with economic benefits there are strategic benefits of encouraging a local defence industry, particularly in areas of technology or equipment production of relevance to the defence of Australia.

Australia also acknowledges the importance of maintaining its alliances, and wherever possible plans to keep its force compatible with its allies, to enable bilateral and coalition operations in support of these alliances. Armed with this knowledge of Australia's environment, clear guidance on areas for development can be given to enable the military and defence support organisations. Australian R&D organisations can focus on developing and identifying military applications for new technology in the identified key defence areas, while the military organisation can be optimised for the development of doctrine and identifying current and future needs within these areas.

Notes

1. Directorate of Publishing, Defence Center Canberra. *1996 Air Force 75th Anniversary*, March 1996, Chief of the Air Staff.

Chapter 4

Research and Development

> *When new military technologies arrive, we must learn to live with them. Hoping they'll go away is futile.*
>
> —Jeffery R. Barnett

As previously mentioned, the development of new technology and military equipment can either be based on an identified need, or on an identified application of new technology. In both cases the R&D organisations need to have a close relationship with the military to maintain the link between the developments and the required or projected capabilities. The military benefits from keeping up to date with new and emerging technologies, by being able to see potential new capabilities and efficiencies that are in the future. The R&D organisations benefit by being able to stay abreast of new directions in operational concepts that may focus research into solving new problems and through feedback on the military's interest in new developments. The US concept of Battle-Labs is a step in this direction, with a closer tie between R&D and the military.[1]

Shrinking budgets also affect R&D, making the establishment of clear ties between immediate and future military needs imperative in securing defence R&D funding. Global cooperation in areas of common interest can offset some of these costs by preventing duplication of effort between allied countries. Australia has invested in a strong R&D organisation, but it is relatively small in size and suffers from limited production capability,

particularly in aviation, meaning a reliance on overseas sources. This raises three issues for focussing Australia's R&D, the expense of paying for other nation's R&D, the unique requirements of Australian defence, and the lag in technology from other nation's releasability issues. A constant balance between these factors drives the direction of R&D budgets.

Australia's Scientific Organisation

The Australian military has only a small uniformed involvement in the area of scientific research and development. The majority of the work is carried out by the government's Defence Science and Technology Organisation (DSTO). DSTO's role is to help the Australian Defence Force (ADF) make best use of technology, and the organisation has a high reputation for practical problem solving.[2] DSTO maintains strong links with military and civilian research institutions both within Australia and overseas, and is a member of the Technical Cooperation Program, together with the US, UK, Canada and New Zealand. The five countries share and combine their knowledge and expertise in the fields of science and technology.[3]

DSTO's objective is to give advice that is professional, impartial and informed on the application of science and technology that is best suited to Australia's defence and security needs. DSTO's activities include:

- influencing the framing and implementing of defence policy for the use of science and technology;
- positioning Australia to exploit future developments in technology which show promise for defence applications;
- ensuring that Australia is an informed buyer of its defence equipment;
- developing new capabilities, especially where there are special national demands including those related to Australia's unique environment;

- supporting existing capabilities by increasing operational performance and reducing the costs of ownership;
- helping industry become better able to support the capabilities needed to defend Australia and, through industry, contributing to national wealth creation; and
- collaborating internationally, both regionally and with Australia's traditional friends and allies, and in support of the Government's broader international objectives.[4]

This list of activities shows that DSTO has an important role in advising the Government and the ADF on military technological issues, in addition to its direct involvement in R&D. DSTO has a limited number of military personnel working within its organisation, and has contact with war-fighters during major exercises, and special projects. This arrangement has proven effective to date, however there is room for improvement through greater cooperation between the military operators and the researchers.

Battle Labs

In the US, Battle Labs provide the military a mechanism for rapidly assessing ideas and capabilities provided by advanced technologies.[5] Early products of new technology often involve software or austere hardware prototypes, the battle labs are able to input these new technology products into real and virtual systems and environments to assess their potential for immediate use or further development.[6] Australia's small force structure would not currently allow for the establishment of a separate US-style Battle-Lab units. However, advanced operational and training simulators and equipment could be designed to support this role. Combined with the communications networks covering Australia, various units, on a limited basis, could be provided with new technology products, linked appropriately to simulate realistic situations. This would allow the testing of the viability of new technology, and expose war-fighters to possible future trends.

While this may detract from a unit's day to day operations, the benefits would justify some of the costs. The R&D organisations would receive valuable operator input to new projects, and the operators would see new technology that could influence the direction of doctrine development and military planning. This interaction could prevent equipment being supplied that didn't meet the military's requirements, and stop units from wasting time developing new procedures to combat problems or vulnerabilities that were soon to be solved with new technology.

Notes

1. Julian Cothran, "Battle Labs: Tools and Scope." *Acquisition Review Quarterly- Winter 1996.* On-line. Internet, 11 December 1996. Available from www.dsmc.dsm.mil/pubs/pdfarq.htm, 52.

2. *Introducing DSTO,* On-line. Internet 9 February 1997. Available from http://www.adfa.oz.au/DOD/dsto.

3. *Introducing DSTO.*

4. *Introducing DSTO.*

5. John R. Wilson, "Battle Labs: Where Are They, Where Are They Going?" *Acquisition Review Quarterly- Winter 1996.* On-line. Internet, 11 December 1996. Available from www.dsmc.dsm.mil/pubs/pdfarq.htm, 63.

6. Cothran, 52.

Chapter 5

Acquisition

> *... many, perhaps most, business practices common in commercial industry for evaluating and controlling operations have no application in the defence world.*
>
> —Mark Cancian

The development of acquisition systems in the post-WWII period resulted in processes that took up to 10-15 years to field major new systems. The previously mentioned exponential rate of technology growth has created a requirement to streamline the acquisition process down to a period of a few years to maintain military equipment near the leading edge of technology. Acquisition reform has been embraced in most nations not just as a method for speeding the process, but also in reaction to declining budgets and the need to ensure the value for money. This reform is present in both the military and in the commercial sector, however differences between the military organisation and commercial organisations do not permit military forces to achieve the streamlined processes evident within many commercial organisations. These differences include:

- There is one buyer—a monopsony— and hence no true market;
- For any particular item, there is often only one or at most a very few sellers;
- The user's "bottom line" is not financial but performance. Competition therefore strongly emphasises performance over price;

- Major contracts are signed years before actual results are available and there-fore must be based on estimates of cost, schedule, and performance;
- Performance is difficult to judge, and is often judged subjectively, except for the rare occasions when the nation actually uses military force on a large scale;
- The enterprise operates with public funds, the use of which is held to a different standard than private funds;
- Decision-making power is diffuse, being shared between the executive branch and the legislative branch (with its many committees and subcommittees); and,
- Decisions and operations are conducted in the open, under great public scrutiny.[1]

The subjective judgement required in military decisions creates several competing issues in the selection and acquisition of equipment, performance, cost, schedule, risk, control, jointness and inter-operability, industrial base, fairness and propriety, socioeconomic.[2] All these factors combine to make the application of many commercial lessons to the military difficult, if not impossible. However, there are many areas within the military where commercial procedures and lessons can be applied, particularly in minor purchases and support functions. This commercialisation frees the defence acquisition system to concentrate on the unique areas of military acquisition.

Accountability

The responsibility of a government to spend the taxpayers money carefully has lead to the development of a system that is open to public scrutiny, and necessarily contains significant oversight. There is also a perceived need for fairness and propriety in government dealings, and a lower tolerance of errors and waste with public money. These influences on the acquisition system add significantly to the work and time involved in procuring equipment. While there is significant waste being removed from the system, several reforms are aimed at reducing the levels of oversight, at the risk of increased abuses. From the outside the reduced cost of less oversight may seem like a risk worth

taking, but in the long run the costs of a large government enterprise going bankrupt could be devastating. Therefore a trade-off must be made between the risks and the level of oversight.[3] The automation of these processes may be the only acceptable option for speeding up the processes while maintaining low risk. Varying levels of oversight for different projects, or classes of projects with less inherent risk, could also be instigated.

Commercialisation

One of the potential areas for saving time and money is in the selection of dual-use technologies and commercial off-the-shelf (COTS) technologies. These technologies provide the military access to a much larger industrial base and can effectively harness the drive of the commercial sector. In rapidly moving areas, such as information systems, commercial products can give a much lower price and higher performance than is possible through defence processes. In some cases for example the computer chips used for automobile engine computers, the commercial specifications have similar, or higher environmental requirements than the military.[4]

However, COTS equipment often involves a trade-off, as most commercial products are not built to withstand the environmental extremes military equipment is subjected to. Other disadvantages of COTS equipment is that the equipment may lack some of the features desired by the military. Including things like self-protection capabilities, and the ability to operate in challenging environments. The other important consideration is the issue of maintaining inter-operability, with many commercial products using proprietary standards where no industry standard exists. This is particularly true of new technology equipment where products may be competing on the open market to establish a standard.

Also , commercial products rarely provide the support and documentation provided with military developed equipment, meaning a possible reliance on a single manufacturer to maintain and update a system.[5]

Therefore COTS equipment purchases need to be considered, not just in terms of cost and individual performance, but also in terms of the system-wide implications and future support. Less cost for higher individual performance may hide an overall performance reduction that is unacceptable.[6] However, procedures and requirements that provide the military greater freedom to search out state of the art equipment from dynamic manufacturers globally, rather than being limited to subsidised defence industries would enhance the use of COTS equipment. For example, the US military chose an army arsenal originally designed during the American Civil War to build new canons rather than making use of the existing railroad equipment manufacturing industry that uses the same fabrication equipment. This meant that new equipment and personnel had to be completely funded by the military, rather than taking advantage of the potential to absorb some of the costs through the continuous industrial use of the equipment, and the availability of round the clock shifts in the commercial sector to operate it.[7]

Military Systems

The most time consuming acquisitions involve major military systems like new combat aircraft, ships, and tanks. Generally the systems are developed and identified as a complete system and subjected to a series of performance requirements and cost limits. The development of a complex system is obviously more time consuming than the development of the sub-systems due to the time spent on integration, and the trade-offs

made to satisfy the performance requirements while still meeting the cost limitations. Often the combination of performance and cost requirements discourages a manufacturer from providing more than the minimum, and can lead to the fielding of equipment that is in need of system upgrades or modifications as soon as it enters service.

Selection criteria that balances both performance and cost, rather than purely cheapest cost with the minimum requirements can provide encouragement to manufacturers to be innovative. The replacement of detailed milspec requirements with required capabilities reduces the workload on acquisition organisations that would have to produce the requirements, and provides manufacturers the ability to optimise an equipment package based on its unique capabilities. A good example of a streamlined acquisition was the recent selection of the new Lead-In Fighter (LIF) for the RAAF. Rather than specifying an exact number of aircraft required, along with serviceability rates, etc., a performance capability along with required flying rates and life of type was detailed. The manufacturers then tendered various package combinations able to meet the requirements based on their designs and data rather than trying to modify the systems to meet exact military specifications.

Notes

1. Wilson, 190-191.
2. Ibid., 191.
3. Ibid., 194.
4. Jacques S. Gansler, *Defence Conversion* (Cambridge, Massachusetts: The MIT Press, 1996), 91.
5. Wilson, 193-194.
6. Ibid., 194.
7. Gansler, 93.

Chapter 6

Operational Integration

> *In war, the quality and smart use of a nation's military technology can mean the difference between victory and defeat.*
>
> —DSTO Web Site

Following the acquisition process, the integration of the new equipment into the military force needs to occur, this involves establishing the organisational structure and logistics, training and development of doctrine. During periods when the military is leading the technology cycle, as in a RMA, the development of doctrine and adaptation of the organisation should already be under way prior to the introduction of the new equipment. The reverse may be true with a MTR, where new technology or equipment is supplied and then the process of integration begins. However, given the finite time-frame of the actual acquisition process there is the potential to actually begin the process of preparing to integrate the new equipment in parallel to the acquisition process. Using the Battle-Lab concept mentioned, this parallel development, particularly in organisational adaptation, could begin even earlier.

Simulation

The use of simulation and computer-based learning has provided significant benefits in the speed, quality and cost of training, by matching learning rates to the individual, and

through the ability to create complex 'virtual' environments with low risk to personnel and equipment. Advanced simulators also permit rapid use of trial and error techniques to develop tactics and doctrine, again at low risk and cost. Computer simulation can contribute in five general areas:

- reduced time, costs and risks in the acquisition process.
- allows the development of doctrine and tactics to begin during development.
- allows realistic joint training through the representation of large-scale forces in synthetic environments.
- allows commanders to evaluate alternative doctrine, tactics and plans.
- provides a facility for mission rehearsal.[1]

The use of simulators during the development and acquisition phases of new equipment in a Battle Lab style role provides two key contributions to easing the problem of integrating new equipment into the military. Firstly, through the interaction of the military and the development organisation the military would be aware of new technology earlier, and could begin development through military input to developer new equipment can be made more operator friendly. Both of these would ease the integration of new technology into a military force.

Simulators also have an important role in both the general training of war-fighters in a safe environment, and allow the rehearsal of specific missions. The ability of simulators to create virtual environments without the cost and time delays of movement of large forces globally, and equipment operating expenses. This provides for accelerated training as an adjunct to real exercises, again easing the integration of the new equipment into the force. Finally, simulators allow leaders to experiment with alternative plans, doctrine and tactics for general or specific applications quickly and cheaply, which will encourage innovation, and speed the MTR cycle of development listed in chapter 2.[2]

The development of simulators with the Battle-Lab concept in mind will further extend the utility of simulators, with the potential to reduce the development time of system upgrades and modifications.

Cooperation with Allies

Australia's limited defence industry has meant a reliance on overseas markets of most of its major weapon platforms, and has also meant a lag in the introduction of these major systems. This has some advantages in the operational integration phase, where lessons learnt by similar allied forces can provide a starting point for doctrinal development. Also, the ability to participate in combined exercises provides operators and planners an early exposure to the new systems.

It is important to start the process of doctrine development and organisational change as early as possible to facilitate the smooth and rapid operational integration of new technology equipment. Simulators provide a valuable tool in this process, and operations with other nations can provide a tremendous head start in the development process. As mentioned previously, it is also important for the military to be kept informed of new technology directions, to maintain their focus towards the future, rather than just applying the lessons of the past.

Notes

1. Barnett, 17-18.
2. Ibid.

Chapter 7

Conclusion

> *As the pace of the world quickens, the value of being first to market with innovative solutions is the key to true competitive advantage. This is true in the commercial marketplace and it is also true in the military market.*
>
> —G. Dean Clubb

There are clear advantages to maintaining high technology equipment both through the enhancement to force capability provided, and the military evolution that it stimulates. While there are going to be periods of both the military leading technology and vice-versa, it is important to maintain a climate that allows for new ideas and the flexibility to adapt to new technology.

There are significant reforms continuing at present to reduce the time consuming processes involved in the bureaucratic acquisition process, however there are limits to the reduction possible in this area due to the responsibilities of a democratic government. Transformation from a system of specifying of what the military wants and how it should be built, to clear statements of what the equipment should be capable of has produced significant savings.

The identification of actual current military needs and an appreciation of possible future needs, specific to the operating environment has also enhanced the acquisition process by narrowing the focus to key areas. The continuing assessment of key areas for

defence planning provided to Australian R&D and military acquisition organisations and planners, and is a key to the efficient use of the budget.

Recommendations

It is important to maintain regular study of Australia's defence needs to keep the areas of importance current. However, it is also essential that the military personnel and support organisations, including local industry, are made aware of the current requirements and strategy. This greater level of communication effectively establishes a larger team looking for solutions to the military's problems.

The closer cooperation of the R&D community with the operational community should be a priority, either through increased exposure during training and exercises or through the enhancement of simulators and equipment to enable use in a battle lab role. Early knowledge of new equipment for military planners and tacticians at this stage could realise opportunities for conducting acquisition and integration planning in parallel with R&D. This has the potential for further reductions in the time for operationally fielding new systems once it is introduced, through the military being better prepared for the equipment, and early feedback enabling the development of a better product. Also, the interaction and sharing of the R&D load between allied nations will help share the cost burden of developing new technology.

During the procurement phase use of COTS equipment and dual-use technology should be sought whenever possible. However, caution to evaluate the long-term implications of any price-performance trade-offs should be carefully weighed. Also, a closer relationship between manufacturers and the military should be encouraged,

particularly during the development process. The provision of contracts with incentives to provide the best performance for price within agreed standards could also realise better equipment. The removal of unnecessary detail in specifications that may be quickly outdated and limit the potential for achieving state of the art, through limiting the use of milspec and providing price / performance incentives should be expanded.

To assist the integration of new technology equipment, greater use of simulators and better simulator networking should be developed. The networking would allow the creation of more realistic environments and provide for more realistic training and evaluation, through the increased level of operator interaction providing a better virtual environment. Simulators, and equipment where possible, should also be designed or upgraded for use as pseudo battle labs through the ability to inject software models or connect hardware prototypes of new technology equipment. This would provide R&D organisations direct access to operator feedback. It would also provide war-fighters a glimpse of possible future equipment that could influence doctrine tactics and organisational developments, enabling more rapid operational integration of new equipment. Greater interaction with allies in exercises, exchanges and training would also allow each nation to benefit from the combined knowledge and diversity of the group, speeding the development cycle.

The key to enabling much of this, is to make use of the existing technological revolution in computing and communications. This technology can not only increase existing capabilities, but can also increase the flexibility and responsiveness of the military organisation to new developments in other areas.

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